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ABSTRACT

The United States Training and Employment Service General Aptitude Test Battery (GATB), first published in 1947, has been included in a continuing program of research to validate the tests against success in many different occupations. The GATB consists of 12 tests which measure nine aptitudes: General Learning Ability; Verbal Aptitude; Numerical Aptitude; Spatial Aptitude; Form Perception; Clerical Perception; Motor Coordination; Finger Dexterity; and Manual Dexterity. The aptitude scores are standard scores with 100 as the average for the general working population, and a standard deviation of 20. Occupational norms are established in terms of minimum qualifying scores for each of the significant aptitude measures which, when combined, predict job performance. Cutting scores are set only for those aptitudes which aid in predicting the performance of the job duties of the experimental sample. The GATB norms described are appropriate only for jobs with content similar to that shown in the job description presented in this report. A description of the validation sample and a personnel evaluation form are also included. (AG)

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S-461

June 1971

U.S. Training and
Employment Service
Technical Report
S-461

Development of USTES

APTITUDE TEST
BATTERY FOR

ASSEMBLER
(elec. equip.)
826.884

**ASSEMBLER,
ELECTRICAL**
(elec. equip.)
826.884

U.S. DEPARTMENT OF LABOR
Manpower Administration

ED 069647

Technical Report on Development of USTES Aptitude Test Battery

for . . . .

Assembler (elec equip.) 826.884
Assembler, Electrical (elec. equip.) 826.884

(Developed in Cooperation with the
Wisconsin State Employment Service)

S-461

U.S. Department of Labor
Manpower Administration

June 1971

FOREWORD

The United States Training and Employment Service General Aptitude Test Battery (GATB) was first published in 1947. Since that time the GATB has been included in a continuing program of research to validate the tests against success in many different occupations. Because of its extensive research base the GATB has come to be recognized as the best validated multiple aptitude test battery in existence for use in vocational guidance.

The GATB consists of 12 tests which measure 9 aptitudes: General Learning Ability, Verbal Aptitude, Numerical Aptitude, Spatial Aptitude, Form Perception, Clerical Perception, Motor Coordination, Finger Dexterity, and Manual Dexterity. The aptitude scores are standard scores with 100 as the average for the general working population, with a standard deviation of 20.

Occupational norms are established in terms of minimum qualifying scores for each of the significant aptitude measures which, in combination, predict job performance. For any given occupation, cutting scores are set only for those aptitudes which contribute to the prediction of performance of the job duties of the experimental sample. It is important to recognize that another job might have the same job title but the job content might not be similar. The GATB norms described in this report are appropriate for use only for jobs with content similar to that shown in the job description included in this report.

GATB Study # 2832

Development of USTES Aptitude Test Battery

For

Assembler (elec. equip.) 826.884-012
Assembler, Electrical (elec. equip.) 826.884-012
S-461

This report describes research undertaken for the purpose of developing General Aptitude Test Battery (GATB) norms for the occupations of Assembler (elec. equip.) 826.884 and Assembler, Electrical (elec. equip.) 826.884. The following norms were established:

GATB Aptitudes	Minimum Acceptable GATB Scores
P - Form Perception	75
K - Motor Coordination	85
F - Finger Dexterity	80
M - Manual Dexterity	80

RESEARCH SUMMARY

Sample:

40 male and 34 female (66 white and 8 Negro) workers who were employed as either Assembler or Assembler, Electrical at General Electric X-ray Corporation, Milwaukee, Wisconsin.

Criterion:

Supervisory ratings.

Design:

Concurrent (test and criterion data were collected at approximately the same time).

Minimum aptitude requirements were determined on the basis of a job analysis and statistical analysis of aptitude mean scores, standard deviations, aptitude-criterion correlations and selective efficiencies.

Concurrent Validity:

Phi Coefficient = .67 (P/2 < .0005)

Effectiveness of Norms:

Only 74 percent of the nontest-selected workers used for this study were good workers; if the workers had been test-selected with the above norms, 90 percent would have been good workers. Twenty-six percent of the non-test-selected workers used for this study were poor workers; if the workers had been test-selected with the above norms, only 10 percent would have been poor workers. The effectiveness of the norms is shown graphically in Table 1.

TABLE 1

Effectiveness of Norms

	Without Tests	With Tests
Good Workers	74%	90%
Poor Workers	26%	10%

SAMPLE DESCRIPTION

Size:

N = 74; 66 white and 8 Negro

Occupational Status:

Employed workers

Work Setting:

Workers who were employed as either Assembler or Assembler, Electrical by the General Electric X-ray Corporation, Milwaukee, Wisconsin.

Employer Selection Requirements:

Education: Ability to read English

Previous Experience: None indicated

Tests: None indicated

Other: Personal interview

Principal Activities:

The job duties for each worker are comparable to those shown in the job description in the Appendix.

Minimum Experience:

All workers in the sample had at least one month of job experience.

TABLE 2

Means, Standard Deviations (SD), Ranges and Pearson Product-Moment Correlations with the Criterion (r) for Age, Education, Experience and Cultural Exposure

	Mean	SD	Range	r
Age (years)	32.2	13.4	18-62	-.120
Education (years)	11.7	1.1	8-15	.145-
Experience (months)	46.6	79.9	1-294	-.134
Cultural Exposure	2.6	1.5	0-6	.077

Experimental Test Battery

All 12 tests of the GATB, B-1002B, and the Research Questionnaire-Background were administered during January 1971.

CRITERION

The criterion data consisted of supervisory ratings of job proficiency. Each worker's immediate supervisor did the rating. Re-ratings were obtained three weeks after the initial rating.

Rating Scale:

The SP-21 "Descriptive Rating Scale" was used. This scale (see Appendix) consists of nine items covering different aspects of job performance. Each item has five alternatives corresponding to different levels of job proficiency.

Reliability:

A reliability coefficient of .83 was obtained between the initial ratings and the re-ratings, indicating a significant relationship. The final criterion score consisted of the combined scores for the two ratings.

Criterion Score Distribution:

Possible Range:	18-90
Actual Range:	39-79
Mean:	57.9
Standard Deviation:	7.2

Criterion Dichotomy:

The criterion distribution was dichotomized into low and high groups by placing 26 percent of the sample in the low group to correspond with the percentage of workers considered unsatisfactory or marginal. Workers in the high criterion group were designated "good workers" and those in the low criterion group as "poor workers." The criterion critical score is 54.

APTITUDES CONSIDERED FOR INCLUSION IN THE NORMS

Aptitudes were selected for tryout in the norms on the basis of a qualitative analysis of job duties involved and a statistical analysis of test and criterion data. Aptitude P which does not have a significant correlation with the criterion was considered for inclusion in the norms since the aptitude was rated of critical importance for the performance of job duties. Tables 3, 4 and 5 show the results of the qualitative and statistical analyses.

TABLE 3

Qualitative Analysis
(Based on the job analysis, the aptitudes indicated appear to be important to the work performance)

Aptitudes	Rationale
P - Form Perception	Required in determining differences in sizes and shapes of parts and to detect defects in parts and in final assembly.
K - Motor Coordination	Required in accurately positioning parts to be assembled, attached and/or fastened.
F - Finger Dexterity	Required in manipulating small parts and hand tools.
M - Manual Dexterity	Required in handling parts to be assembled and in operating hand and portable power tools.

TABLE 4

Means, Standard Deviations (SD), Ranges and Pearson Product-Moment Correlations with the Criterion (r) for the Aptitudes of the GATB: N = 74

	Mean	SD	Range	r
G - General Learning Ability	101.0	15.6	55-138	.199
V - Verbal Aptitude	98.2	13.6	66-133	.117
N - Numerical Aptitude	99.6	14.1	63-128	.208
S - Spatial Aptitude	105.1	18.7	51-150	.169
P - Form Perception	104.6	17.9	46-142	.206
Q - Clerical Perception	109.3	13.5	77-146	.274*
K - Motor Coordination	101.3	14.3	62-126	.293*
F - Finger Dexterity	108.9	16.7	72-153	.413**
M - Manual Dexterity	110.6	19.5	68-152	.409**

* Significant at the .05 level.
** Significant at the .01 level.

TABLE 5

Summary of Qualitative and Quantitative Data

Type of Evidence	Aptitudes								
	G	V	N	S	P	Q	K	F	M
Job Analysis Data									
Important					X*		X	X	X
Irrelevant									
Relatively High Mean						X		X	X
Relatively Low Standard Dev.		X	X			X	X		
Significant Correlation with Criterion						X	X	X	X
Aptitudes to be Considered for Trial Norms					* **P**	**Q**	**K**	**F**	**M**

DERIVATION AND VALIDITY OF NORMS

Final norms were derived on the basis of the degree to which trial norms consisting of various combinations of aptitudes P, Q, K, F and M at trial cutting scores were able to differentiate between 74 percent of the sample considered to be good workers and 26 percent of the sample considered to be poor workers. Trial cutting scores at five-point intervals approximately one standard deviation below the mean are tried because they will eliminate about one-third of the sample with three-aptitude norms. For two-aptitude trial norms, minimum cutting scores of slightly more than one standard deviation below the mean will eliminate about one-third of the sample. For four-aptitude trial norms, cutting scores slightly less than one-third below the mean will eliminate about one-third of the sample. The Phi Coefficient was used as a basis for comparing trial norms. Optimum differentiation for the occupations of Assembler (elec. equip.) 826.884-012 and Assembler, Electrical (elec. equip.) 826.884-012 was provided by the norms of P-75, K-85, F-80 and M-80. The validity of these norms is shown in Table 6 and is indicated by a Phi Coefficient of .67 (statistically significant at the .0005 level).

TABLE 6

Predictive Validity of Trial Norms
P-75, K-85, F-80 and M-80

	Nonqualifying Test Scores	Qualifying Test Scores	Total
Good Workers	2	53	55
Poor Workers	13	6	19
Total	15	59	74

Phi-Coefficient = .67

Chi Square (X^2_y) = 32.8

Significance Level = P/2 < .0005

DETERMINATION OF OCCUPATIONAL APTITUDE PATTERN

The data for this study met the requirements for incorporating the occupation studied into OAP-61 included in Section II of the 1970 edition of the Manual for the General Aptitude Test Battery. A phi coefficient of .46 is obtained with the OAP-61 norms of K-90, F-85 and M-90.

WSES-1004 (3/67)

JOB PERFORMANCE RATING FORM
(For Aptitude Test Development Studies)

JOB TITLE _____ SCORE _____
D.O.T. TITLE AND CODE

WORKER'S EXPERIENCE _____ JOB TRAINING PERIOD _____
(Exact number of months) (months)

DIRECTIONS: Please read the sheet "Suggestions to Raters" and then fill in the items listed below. In making your ratings, only one box should be checked for each question.

NAME OF WORKER (print) _____
(last) (first)

SOCIAL SECURITY NUMBER _____ SEX: Male _____ Female _____

COMPANY _____ LOCATION _____

COMPANY JOB TITLE: _____

RATED BY _____ TITLE _____

How often do you see this worker in a work situation?

- ☐ See him at work all the time.
- ☐ See him at work several times a day.
- ☐ See him at work several times a week.
- ☐ Seldom see him in work situation.

How long have you worked with him?

- ☐ Under one month.
- ☐ One to two months.
- ☐ Three to five months.
- ☐ Six months or more.

A. How much work can he get done? (Worker's ability to make efficient use of his time and to work at high speed.)

- ☐ 1. Capable of very low work output. Can perform only at an unsatisfactory pace.
- ☐ 2. Capable of low output. Can perform at a slow pace.
- ☐ 3. Capable of fair work output. Can perform at a acceptable but not a fast pace.
- ☐ 4. Capable of high work output. Can perform at a fast pace.
- ☐ 5. Capable of very high work output. Can perform at an unusually fast pace.

B. How good is the quality of his work? (Worker's ability to do high-grade work which meets quality standards.)

- ☐ 1. Very poor. Does work of unsatisfactory grade. Performance is inferior and almost never meets minimum quality standards.
- ☐ 2. Not too bad, but the grade of his work could stand improvement. Performance is usually acceptable but somewhat inferior in quality.
- ☐ 3. Fair. The grade of his work is mediocre. Performance is acceptable but usually not superior in quality.
- ☐ 4. Good, but the grade of his work is not outstanding. Performance is usually superior in quality.
- ☐ 5. Very good. Does work of outstanding grade. Performance is almost always of the highest quality.

C. How accurate is he in his work? (Worker's ability to avoid making mistakes.)

- ☐ 1. Very inaccurate. Makes very many mistakes. Work needs constant checking.
- ☐ 2. Inaccurate. Makes frequent mistakes. Work needs more checking than is desirable.
- ☐ 3. Fairly accurate. Makes mistakes occasionally. Work needs only normal checking.
- ☐ 4. Accurate. Makes few mistakes. Work seldom needs checking.
- ☐ 5. Highly accurate. Rarely makes a mistake. Work almost never needs checking.

D. How much does he know about his job? (Worker's understanding of the principles, equipment, materials and methods that have to do directly or indirectly with his work.)

- ☐ 1. Has very limited knowledge. Does not know enough to do his job adequately.
- ☐ 2. Has little knowledge. Knows enough to "get by."
- ☐ 3. Has moderate amount of knowledge. Knows enough to do fair work.
- ☐ 4. Has broad knowledge. Knows enough to do good work.
- ☐ 5. Has complete knowledge. Knows his job thoroughly.

E. How much aptitude or facility does he have for this kind of work? (Worker's adeptness or knack for performing his job easily and well.)

- ☐ 1. Very low aptitude. Has great difficulty doing his job. Not at all suited to this kind of work.
- ☐ 2. Low aptitude. Usually has some difficulty doing his job. Not too well suited to this kind of work.
- ☐ 3. Moderate aptitude. Does his job without too much difficulty. Fairly well suited to this kind of work.
- ☐ 4. High aptitude. Usually does his job without difficulty. Well suited to this kind of work.
- ☐ 5. Very high aptitude. Does his job with great ease. Unusually well suited for this kind of work.

F. How large a variety of job duties can he perform efficiently? (Worker's ability to handle several different operations in his work.)

- ☐ 1. A very limited variety. Cannot perform different operations adequately.
- ☐ 2. A small variety. Can perform few different operations efficiently.
- ☐ 3. A moderate variety. Can perform some different operations with reasonable efficiency.
- ☐ 4. A large variety. Can perform several different operations efficiently.
- ☐ 5. An unusually large variety. Can do very many different operations efficiently.

G. How resourceful is he when something different comes up or something out of the ordinary occurs? (Worker's ability to apply what he already knows to a new situation.)

☐ 1. Very unresourceful. Almost never is able to figure out what to do. Needs help on even minor problems.

☐ 2. Unresourceful. Often has difficulty handling new situations. Needs help on all but simple problems.

☐ 3. Fairly resourceful. Sometimes knows what to do, sometimes doesn't. Can deal with problems that are not too complex.

☐ 4. Resourceful. Usually able to handle new situations. Needs help on only complex problems.

☐ 5. Very resourceful. Practically always figures out what to do himself. Rarely needs help, even on complex problems.

H. How often does he make practical suggestions for doing things in better ways? (Worker's ability to improve work methods.)

☐ 1. Never. Sticks strictly with the routine. Contributes nothing in the way of practical suggestions.

☐ 2. Very seldom. Slow to see new ways to improve methods. Contributes few practical suggestions.

☐ 3. Once in a while. Neither quick nor slow to see new ways to improve methods. Contributes some practical suggestions.

☐ 4. Frequently. Quick to see new ways to improve methods. Contributes more than his share of practical suggestions.

☐ 5. Very often. Extremely alert to see new ways to improve methods. Contributes an unusually large number of practical suggestions.

I. Considering all the factors already rated, and only these factors, how satisfactory is his work? (Worker's "all-round" ability to do his job.)

☐ 1. Definitely unsatisfactory. Would be better off without him. Performance usually not acceptable.

☐ 2. Not completely satisfactory. Of limited value to the organization. Performance somewhat inferior.

☐ 3. Satisfactory. A fairly proficient worker. Performance generally acceptable.

☐ 4. Good. A valuable worker. Performance usually superior.

☐ 5. Outstanding.. An unusually competent worker. Performance almost always top notch.

FACT SHEET S-461

Job Titles: Assembler (elec. equip.) 826.884-012
Assembler, Electrical (elec. equip.) 826.884-012

Job Summary:

Performs any one or a combination of operations to assemble and/or wire component parts of x-ray heads, tables and control stands.

Work Performed:

Column Assembly - Inserts 16 bearing assemblies into precut holes of 2, 4 and 8 inch square and 4 feet long metal tubing with the eccentric cam bearings on one side. Tightens holding nuts of non-eccentric bearings with a hand wrench. Places setting gage between the sets of bearings and turns the eccentric bearing cam clockwise towards the gage until snug with gage. Holds stud with an allen wrench with one hand and tightens nut with a wrench with other hand. Repeats setting the other eccentric bearings in the same way, checks track clearance between bearings by holding one bearing between index finger and thumb of one hand with nominal pressure and passing the gage between the two bearings noting whether the opposite bearing rotates. Makes needed adjustments in the setting of the eccentric bearing. Checks the clearance between each set of bearings in the same way. Attaches 28 volt relay fuse lay and cable holders to the bar supply with screws using a screw driver. Attaches sliding track to two sides of 4 inch square metal tubing with screws. Attaches pulley assembly to 8 inch square metal tubing with screws in addition to the sliding track. Inserts 2 inch column assembly into 4 inch, the 4 inch into the 8 inch and the 8 inch into the outer column. Checks sliding action of each unit. If stickiness occurs, uses honing stone to take burrs off of track or bearing assembly. Wipes smudges from the surface with rag. Places assembled column on table for final inspection.

Basic Table Assembler - Attaches pulleys, track and operating levers to basic table using wrenches and screw drivers. Solders harness and cables to switch plate terminals. Installs two sets of switches and cables into the handle assembly unit using a screw driver. Checks funtioning of switches by pressing each one with fingers. Attaches hinge assembly into leaded shield lined apron using a riveting machine. May package a supply of the correct number and size of screws, washers, nuts and bolts to be attached to table for use in final assembly.

Electric Motor Attachment Assembler - Attaches a base plate, spacers and shock mounts to previously assembled electric motor housing, weighing about 25 lbs., by inserting 4 bolts through holes in housing, shock mounts and base plate. Attaches a nut to each bolt and tightens slightly with a hand wrench. Uses a torque wrench to tighten nuts to within ± 5 lbs. of the desired torque. Uses "lock-tight" to seal nut from unscrewing due to vibration of motor.

High Voltage Switch Assembler - Places frame of unit in adjustable vise. Mounts solenoid on frame with nuts and bolts using nutdriver and screwdriver. Connects leads from solenoid to plugs using power nutdriver. Cuts excess lead wire with wire cutters. Measures length of movement of three contacts in solenoid and adjusts movements to .01 inch using a meter. Ties wires leading from solenoid to plugs with string. Carries assembled unit to adjacent shelf.

Photo Timer Auxiliary Panel Assembler - Clamps chassis in vise. Assembles unit according to diagramed instructions. Obtains chassis, electrical components and wires from bins on workbench. Attaches components such as relays, potentiometers, fuse holders, and terminal boards to chassis with nuts, bolts and lockwashers with screwdrivers and nutdrivers. Wires unit by connecting various colored wires between terminals of components by looping ends of wires around component terminals with needlenose pliers.

Solders all connections with soldering iron. Checks all wires and components. Releases chassis from vise and places in storage crate.

Tube Support Assembler - Lifts frame from crate, using both hands and places on workbench. Reads diagramed instructions to assemble unit. Attaches metal plates used for additional component mounting, locking device and terminal board to tube support frame using nuts, lockwashers and bolts. Tightens nuts and bolts with screwdriver and nutdriver. Attaches various colored wires with terminal lugs on ends to terminals on terminal board with a "terminal push-on." Checks wires and other assembled parts. Carries completed unit to another crate.

Illuminator Assembler - Assembles unit according to diagramed instructions. Lays cabinet on workbench and attaches chrome bars, light springs, microswitches, rocker switches, wires, fluorescent bulb starter and chrome trimming to front of cabinet using nuts and bolts tightened with power and manual screwdrivers. Examines nuts and bolts for plating. Wires rocker and microswitches in parallel with insulated wire. Slides springs into chrome bars and adjusts to hold x-ray pictures on translucent glass by tension. Attaches instruction sticker to cabinet next to fluorescent bulb starter. Lays sub-panels of cabinet in front of cabinet and pokes wires from plug through hole in sub-panel. Connects wires from plug by twisting with fingers and capping with small conical plastic caps and tightens with power crimping tool. Sets sub-panel in place over wires and fastens to back of panel so that plug protrudes, using washers, lockwashers, and bolts and tightens with power tool. Checks sub-panels with fingers to see if secure. Pokes lamp clamps into back of cabinet and then installs circular fluorescent lamps in cabinet, connecting wires to lamps via plug and prongs on lamps. Covers entire assembly with pane of translucent glass. Inspects operation of completed unit by placing sample x-ray picture under top chrome bar and operating rocker switches.

Rotary Switch Assembler - Clamps switch in vise. Reads diagramed instructions. Pulls un-insulated wire from spool at side as needed. Connects un-insulated wires from point to point on switch by looping wires through switch terminals using needlenose pliers. Connects various colored insulated leads to switch terminals. Cuts excess wire with wire cutters. Solders all connections. Attaches switch to small metal plate with nuts and bolts with screwdriver and nutdriver. Cables colored wire leads using waxed twine. Checks all connections. Carries bunches of switches to nearby crate.

Effectiveness of Norms:

Only 74 percent of the nontest-selected workers used for this study were good workers; if the workers had been test-selected with S-461 norms, 90 percent would have been good workers. Twenty-six percent of the nontest-selected workers used for this study were poor workers; if the workers had been test-selected with S-461 norms, only 10 percent would have been poor workers.

Applicability of S-461 Norms:

The aptitude test battery is applicable to jobs which include a majority of the job duties described above.

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